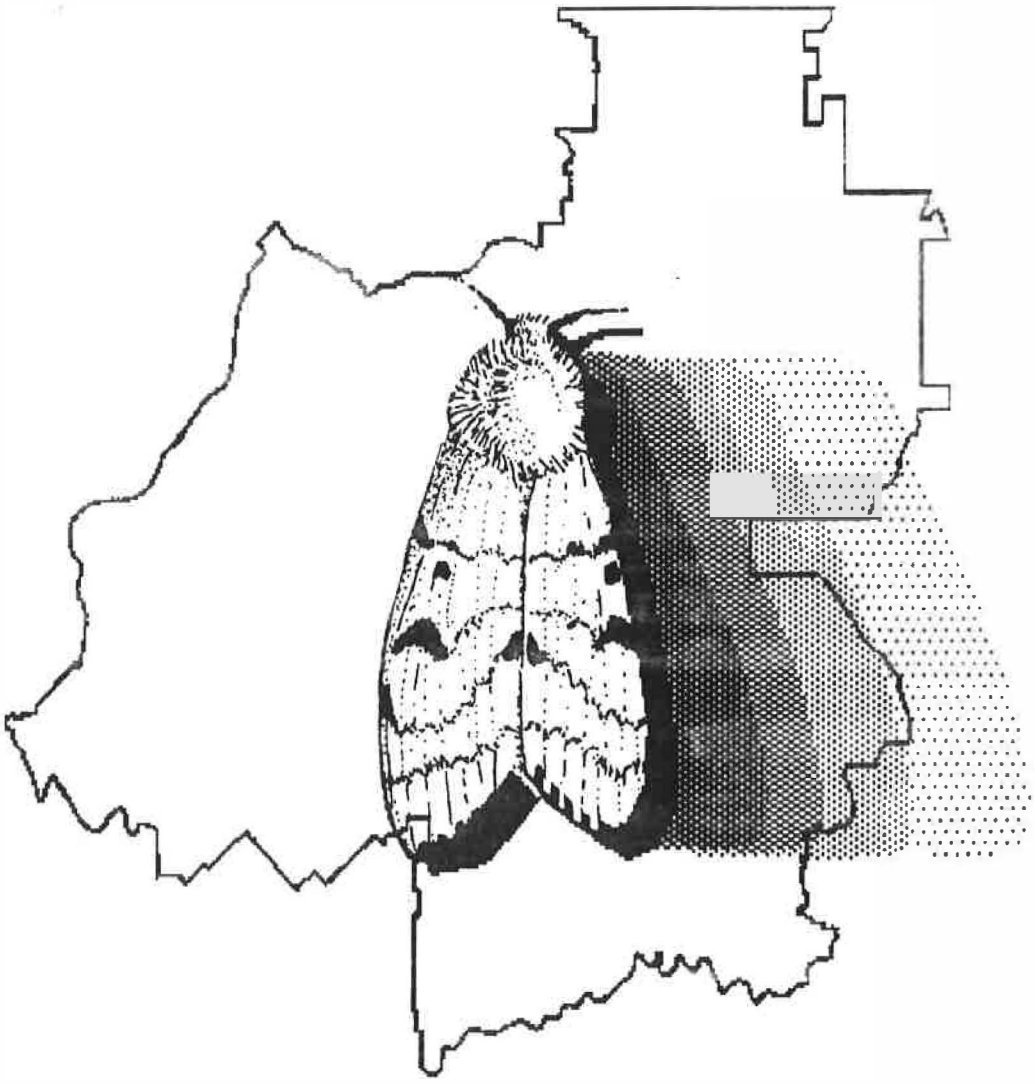
BIOLOGICAL EVALUATION OF GYPSY MOTH POPULATIONS, ALLEGHENY NATIONAL FOREST, PENNSYLVANIA 1993



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NORTHEASTERN AREA
State and Private Forestry

BIOLOGICAL EVALUATION OF GYPSY MOTH POPULATIONS ALLEGHENY NATIONAL FOREST, PENNSYLVANIA 1993

SUMMARY

Egg mass densities of the gypsy moth, *Lymantria dispar* (Linneaus), decreased dramatically over much of the Allegheny National Forest, from 1992 to 1993. Only eight forested areas have gypsy moth infestations at or above the defoliation/damage thresholds that would require protection by spraying. Approximately 11,215 acres have gypsy moth densities ranging from 750 to 13,120 egg masses per acre, but the rest of the Forest has population densities that do not exceed the minimum treatment decision level.

Areas of potentially defoliating populations should be considered for spraying during May 1994 to reduce defoliation (and the associated risks of tree mortality and timber loss), to lessen larval nuisance to recreationists, and to maintain tree species diversity for wildlife and forest health.

INTRODUCTION AND BACKGROUND

Moderate defoliation occurred in 1993 on only 1,975 acres of the Allegheny National Forest (ANF). This represented a dramatic decrease from the 13,690 acres defoliated the previous year and was only about 600 acres higher than the first areas of gypsy moth defoliation detected on the ANF in 1984. During the ten year period from 1984-1993, gypsy moth defoliation has cumulatively totalled 225,165 acres. This defoliation results in even greater stress when the trees are subjected to drought conditions. Substantial oak tree mortality, when defoliation and drought have coincided, has resulted in major salvage sales within the Sheffield, Bradford, and Marienville Ranger Districts.

There also has been concern among ANF land managers as to the affects of tree mortality on the way the oak forest type should be managed. Originally, only high value timber stands and developed recreation sites were considered when planning ANF suppression projects. Following the oak mortality of 1988, priorities for selecting spray blocks are now based on maintaining the overall tree species diversity throughout the Forest. In response to these changing priorities, Forest Health Protection (FHP) has designed the gypsy moth egg mass surveys to now provide information on gypsy moth infestations throughout the entire susceptible host types of the ANF.

OBJECTIVES

The objectives of this biological evaluation were: 1) to accurately assess current gypsy moth population densities within the susceptible forest types of the Allegheny National Forest; 2) to determine the likelihood of unacceptable impacts on its forest resources occuring in the next growing season; and 3) to develop treatment alternatives and recommendations.

SURVEY PROCEDURES

During this year's survey, 1/40th acre plots were used to estimate egg mass densities within susceptible forest type areas. Only the high priority susceptible forest type areas shown on Map 1 were surveyed due to resource and time limitations.

About 650, 1/40th acre plots were placed randomly through the susceptible forest type on the ANF. At each survey point, a range pole (with a 6-3/4 inch horizontal target at a height of 5 feet) was placed at plot center; the surveyor then used a 10 BAF prism to sight on the target and establish an 18.6 foot radius plot boundary. Based on that boundary, an imaginary cylinder was extended from the ground through the canopy and all new egg masses within this cylinder were tallied. The plot counts ware multiplied by 40 to calculate the egg mass densities per acre.

Additional information taken at these sample plots included the approximate percentage of oak in the stand to help interpret variations in egg mass counts. Also, the general size of the egg masses and the presence of adult wasp parasites, *Ooencyrtus kuvanae* (Howard), on the egg masses were noted as an indication of gypsy moth population health and trends. When gypsy moth caterpillar cadavers were found, they were collected and later checked in the laboratory for *Entomophaga* fungus and gypsy moth NPV.

The relationship between egg mass density and subsequent defoliation intensity to host type trees (as published by David Gansner, USFS-NEFES, Radnor, PA) were used to predict the potential 1994 defoliation. Egg mass densities below 750 per acre can cause light defoliation (10-30 percent of the foliage eaten); egg mass densities above 750 per acre can be expected to cause moderate defoliation (30-60 percent); and, those greater than 1,500 egg masses per acre can result in severe defoliation (60-100 percent).

RESULTS

Gypsy moth populations in 1993 have decreased substantially within most areas of the Allegheny National Forest except for the Bradford RD. Table 1 summarizes data for the areas shown on Map 2 of the Bradford RD where the highest gypsy moth egg mass counts are concentrated. Population densities are increasing, the vigor of the populations seem to be increasing slightly. This year's egg masses were somewhat larger (large as compared to medium/large egg masses in 1992) and parasitism is only evident on about one-fifth of the plots. On all of the other three Ranger Districts, gypsy moth egg mass densities were low with only a scattering of plots exceeding the 750 minimum threshold.

Table 1. -- 1993 Gypsy Moth Egg Mass Survey Results,
Bradford RD, Allegheny National Forest, PA

Ranger District	Egg Mass/Acre Range	Egg Mass Size	Approx % Oak Plots	% of Plots with Parasites	1992-1993 Population Trend
Bradford	750-13,120	Lrge	80	18	Increasing

The areas of the Bradford RD shown on Map 2 can be expected to experience varying amounts of defoliation in 1994. A total of 11,215 acres has the potential for gypsy moth defoliation on the Bradford RD in 1994. The following acres are predicted for each class of defoliation: 3,692 acres in the light class (10-30 percent); 2,222 acres in the moderate class (30-60 percent); 8,993 acres in the severe class (60-100 percent). Large areas of moderate to severe gypsy moth defoliation elsewhere on the Allegheny NF are not likely in 1994.

DISCUSSION

In areas with defoliating level gypsy moth populations (greater than 750 egg masses per acre) viral and fungal epizootics generally manifest themselves after significant tree defoliation has already begun occurring. Gypsy moth populations will usually peak in 2-3 years once they reach defoliating levels and then collapse as a result of NPV or fungal activity. Residual populations following such a collapse will likely remain at low densities for 3-6 years before rebuilding to defoliating levels. Although it is possible that gypsy moth populations could collapse on their own due to the presence of nucleopolyhedrosis virus (NPV) or the more recently recognized fungal pathogen, *Entomophaga maimaiga*, it is not possible to accurately assess such possibilities on the Bradford RD with the information at hand. However, the large egg mass size and the increasing population trend west of Allegheny Reservoir suggest that populations there will continue at outbreak densities in 1994.

Trees that are defoliated in excess of 40 percent normally refoliate the same growing season. Such events cause the trees to expend valuable energy reserves to refoliate and consequently cause the trees' health to deteriorate. Depending on the condition of the trees at the time of defoliation, reduced growth, branch dieback or in some cases tree mortality, are likely to occur following a single year of heavy defoliation. Should defoliation occur again the following year, the impact is compounded. Trees that receive light-moderate defoliation (<40 percent) generally will not refoliate and there is probably no significant impact other than some reduction in growth.

Aerial suppression should be considered in FY 94 because: 1) the high gypsy moth population densities are concentrated around the Allegheny Reservoir on the Bradford RD where recent outbreaks have stressed trees; 2) there is an abundance of gypsy moth susceptible tree species in this area on the Allegheny National Forest where several stress factors coexist; and 3) the past history of gypsy moth on the ANF reveals the potential for serious impacts.

TREATMENT ALTERNATIVES

NO ACTION

If the no action alternative is chosen, the potential exists for nuisance level larval populations and moderate to severe defoliation on the Bradford RD and in isolated areas across the ANF. Should such defoliation occur, there is a high probability of additional tree mortality. Further, should no intervention action occur to reduce gypsy moth populations in 1994, it is likely that population densities will increase and expand to currently uninfested areas in 1995.

USE OF CHEMICAL INSECTICIDE

A second option is to use a chemical insecticide to control gypsy moth populations. Diflubenzuron (DFB) is the most widely used chemical insecticide in gypsy moth suppression projects in the northeast. DFB is an insect growth regulator that disrupts the normal molting processes of the larvae. The mode of action is to inhibit the formation of chitin (a necessary component of the insect body wall) which causes the affected larvae to die during the molting process following treatment. The method of uptake is primarily by ingestion, however, recent research has indicated the possibility of limited absorption through the cuticle as well.

DFB is extremely toxic to some aquatic invertebrates, and its application over open water or wetlands should be avoided. With proper application, foliage protection and a significant population reduction can be expected with DFB. The need for treatment of residual populations the following year would be unlikely.

USE OF MICROBIAL INSECTICIDE

The third option is to use a microbial insecticide to manage gypsy moth populations. The only biological insecticide currently registered and commercially available for gypsy moth control is the insecticide *Bacillus thuringiensis* variety *kurstaki* (*B.t.k.*). This insecticide is available through several manufacturers and has been used extensively in suppression projects throughout the U.S. in both forested and residential areas. *B.t.k.* is a bacterium that acts specifically against lepidopterous larvae as a stomach poison and therefore must be ingested. The major mode of action is mid-gut paralysis which occurs soon after ingestion causing a cessation of feeding and death by starvation.

B.t.k. formulations are available as flowable concentrates, wettable powders, and emulsifiable suspensions. In 1994, *B.t.k.* at 36 billion international units (BIUs) per acre in a single application or in double applications could be used, depending on gypsy moth densities. *B.t.k.* can be applied either undiluted or mixed with water for a total volume of 1/2 - 1 gallon per acre. With proper application, foliage protection and some degree of population reduction can be expected with one application. With two applications, both foliage protection and a significant pcpulation reduction are likely. The degree of population reduction varies and may depend on the selected application rate, population densities, the weather (rain and temperature), and the feeding activity of the larvae following treatment. Infested areas with egg mass densities below 1500 per acre are treated once and areas above 1500 per acre should be treated twice.

RECOMMENDATIONS

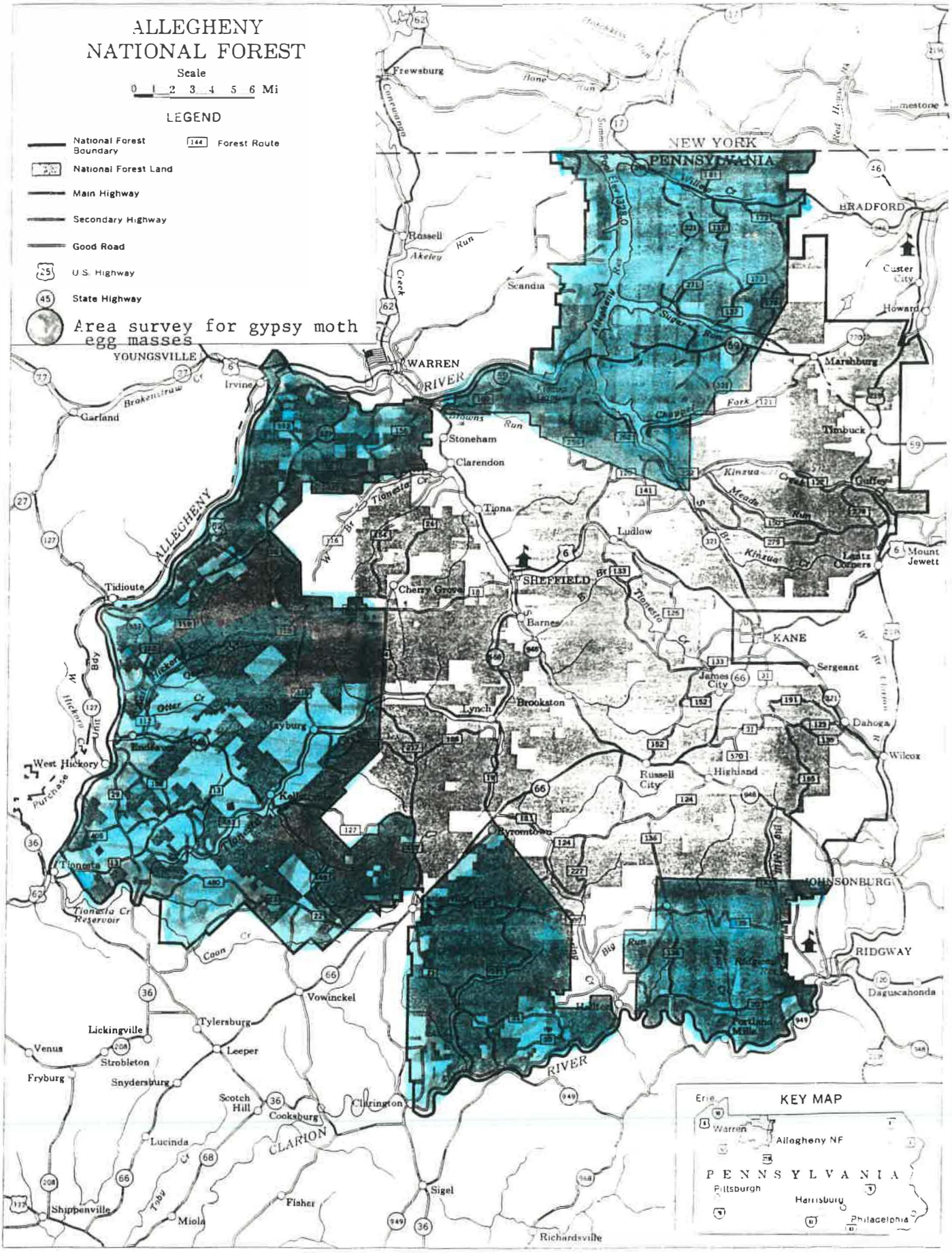
FHP recommends the ANF consider the aerial suppression alternative.

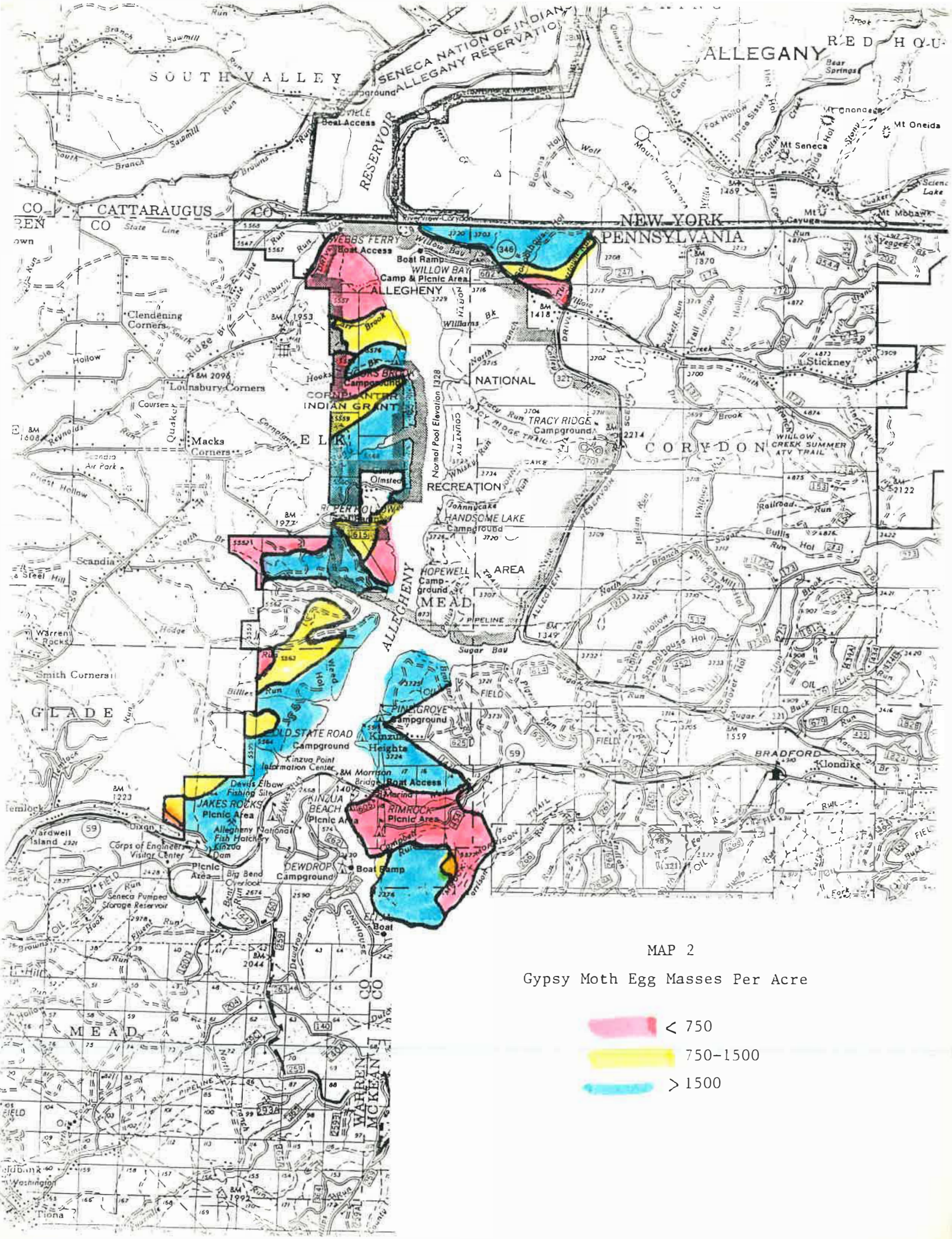
Potentially damaging gypsy moth populations exist within several areas of susceptible forest type on the ANF and occur within stands managed for tree species diversity, timber, and recreation. Basically, the ANF managers have two options:

1) no action
2) aerially spray in selected areas with registered chemical or microbial insecticides to prevent nuisance, defoliation, and subsequent tree mortality

If the no action alternative is chosen, the potential exists for nuisance and moderate to severe defoliation on the Bradford RD and in isolated areas across the ANF. Although research has shown that second outbreak episodes of gypsy moth result in reduced tree mortality rates, the Allegheny National Forest should seriously consider the consequences of additional oak mortality occurring in stands stressed by defoliation during previous outbreaks. National Forest resource values such as recreation, timber, and tree species diversity would be protected by suppressing building gypsy moth populations now rather than waiting until a large scale outbreak develops.

MAP 1.


ALLEGHENY
NATIONAL FOREST
Scale
0 1 2 3 4 5 6 Mi
LEGEND
National Forest Boundary
144 Forest Route
National Forest Land
Main Highway
Secondary Highway
Good Road
25 U.S. Highway
45 State Highway
Area survey for gypsy moth egg masses
NEW YORK
PENNSYLVANIA
BRADFORD
WARREN
YOUNGSVILLE
SHEFFIELD
KANE
JOHNSONBURG
RIDGWAY
Frewsburg
Russell
Scandia
Custer City
Howard
Marshburg
Irvine
Garland
Stoneham
Clarendon
Tiona
Ludlow
Timbuck
Mount Jewett
Tidioute
Cherry Grove
Barnes
Sergeant
James City
Lynch
Brookston
Dahoga
Wilcox
West Hickory
Tionesta
Russell City
Highland
Byromville
Vowinckel
Tylersburg
Lickingville
Venus
Strobleton
Leeper
Fryburg
Snydersburg
Scotch Hill
Cooksburg
Clarington
Lucinda
Shippenville
Miola
Fisher
Sigel
Richardsville
Portland Mills
Daguscahonda
ALLEGHENY RIVER
CLARION RIVER
Tionesta Cr Reservoir
KEY MAP
Erie
Warren
Allegheny NF
PENNSYLVANIA
Pittsburgh
Harrisburg
Philadelphia



MAP 2

Gypsy Moth Egg Masses Per Acre

< 750

750–1500

> 1500